STUDY OF CELLULOSE-BASED FABRICS TREATED WITH MODIFIED AEROSIL-380 NANOPARTICLES

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Abstract
The article studies 4 different types of cellulose-based fabrics treated with modified aerosil-380 nanoparticles. The initial state of the treated fabric samples and their state after aqueous treatment were microscopically examined. The results of the studies showed that the flame-retardant properties of the fabrics treated with aqueous treatment in accordance with the requirements of regulatory documents were preserved.

Introduction
Today, it can be seen that nanoparticles and nanotechnologies are used in many areas. These are the production of building materials, pharmaceuticals, information technology (IT), robotics, various industrial products, etc. [1-2].
Nanoparticles and various compositions based on them, including nanosuspensions, have been used in many studies due to their unique important physicochemical and thermophysical properties. In this type of research, one of the most frequently used nanoparticles as a research object is silicon dioxide nanoparticles. Scientific sources describe silicon dioxide nanoparticles and their use in research, and they are widely used in the production of various products, including textile materials, by influencing their properties and producing various products with a new level of quality [3-5].
In this study, samples of fabrics treated with Aerosil-380 nanoparticles modified with compounds such as ammonium polyphosphate, sodium acetate, magnesium hydrogen phosphate, sodium tetraborate, diethylene glycol, polypropylene glycol, and as a result of their treatment, studies were carried out using Altami MET 1C digital microscopes in order to study the nature of the interaction between nanoparticles and cellulose fibers in the structures of these fabrics and the results were obtained (Figures 1-4).
First, the untreated samples of cellulose fabrics treated with a 0.1% modified Aerosil-380 suspension under 400 W ultrasound conditions and the samples treated with a 5.0% modified Aerosil-380 suspension under 400 W ultrasound conditions were studied using the microscopic research method.

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At this stage, the samples of fabrics treated with nanoparticle suspensions were subjected to 5-fold water treatment in accordance with the requirements of the GOST 11209-2014 standard. 3 times of 5-fold water treatment were carried out. In the 3rd stage, 10-fold water treatment was increased to the animal and this process was continued. Then, after drying the samples treated with this treatment, the condition of the fabrics was examined using a digital microscope (Figures 1-4).

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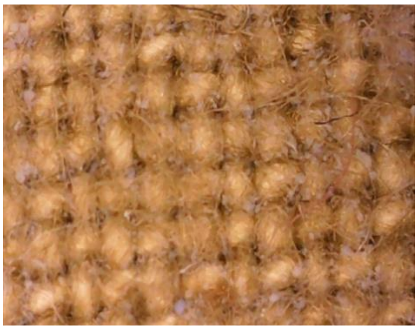

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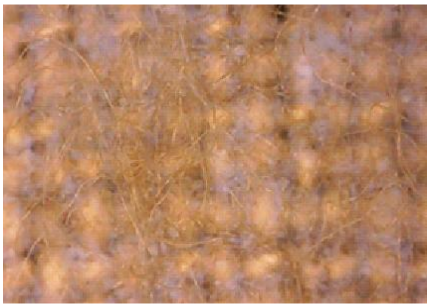

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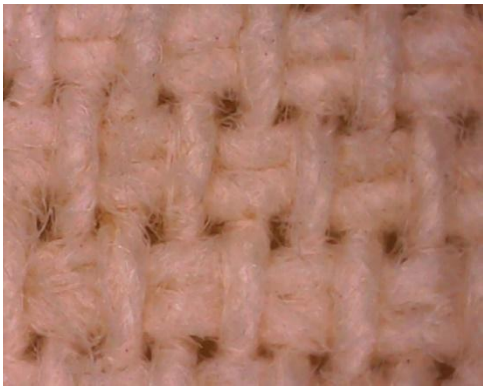
Figure 1. The state of the brown fabric after the treatment of the untreated (No. 1) and modified sample with a 5.0% suspension of modified Aerosil-380 under 400 W ultrasound conditions.

In Figure 1, No. 1 is the unmodified and untreated sample (control sample). No. 4 is the state of the modified sample with a 5.0% suspension of modified Aerosil-380 under 400 W ultrasound conditions before the treatment. No. 3 is the state of fabric sample No. 4 after 5 times of water treatment, No. 2 is the state of fabric sample No. 4 after 10-15 times of water treatment.



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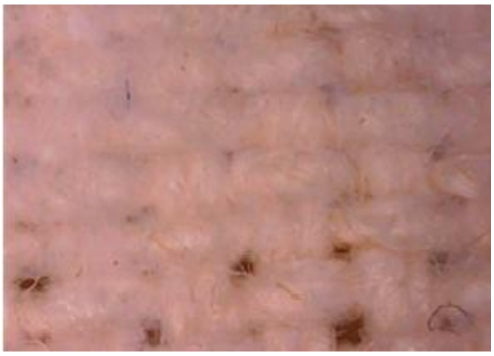

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Figure 2. The state of the untreated (No. 1) and modified samples of white undyed fabric after aqueous treatment with a 5.0% suspension of modified Aerosil-380 under 400 W ultrasonic conditions.

In Figure 2, No. 1 is the unmodified and untreated sample (control sample). No. 4 is the state of the modified sample before aqueous treatment with a 5.0% suspension of modified Aerosil-380 under 400 W ultrasonic conditions. No. 3 is the state of fabric sample No. 4 after 5 times of aqueous treatment, No. 2 is the state of fabric sample No. 4 after 10-15 times of aqueous treatment.

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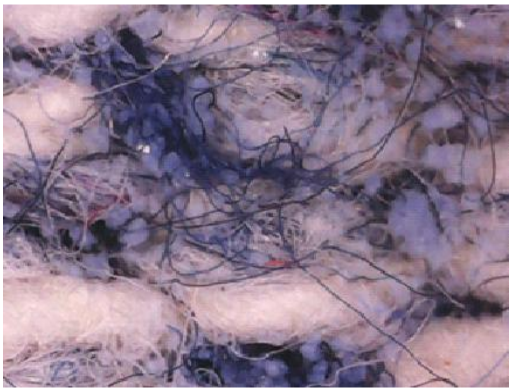

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Figure 3. The state of the untreated (No. 1) and modified black and white fabric sample after water treatment with a 5.0% suspension of modified Aerosil-380 under 400 W ultrasound conditions.

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In Figure 3, No. 1 is the unmodified and untreated sample (control sample). No. 4 is the state of the modified sample before water treatment with a 5.0% suspension of modified Aerosil-380 under 400 W ultrasound conditions. No. 3 is the state of fabric sample No. 4 after 5 times of water treatment, No. 2 is the state of fabric sample No. 4 after 10-15 times of water treatment.

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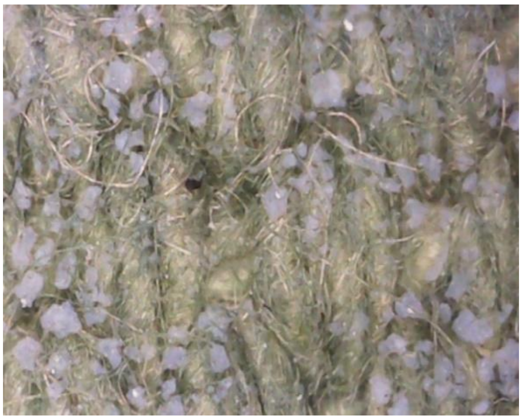

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Figure 4. The state of the untreated (No. 1) and modified samples of tarpaulin fabric with a 5.0% suspension of Aerosil-380 under 400 W ultrasonic exposure conditions after aqueous treatment.

In Figure 4, No. 1 is an unmodified and untreated sample (control sample). No. 4 is a modified sample with a 5.0% suspension of modified Aerosil-380 under 400 W ultrasound conditions before water treatment. No. 3 is the state of fabric sample No. 4 after 5 times of water treatment, No. 2 is the state of fabric sample No. 4 after 10-15 times of water treatment.

In the course of subsequent studies, tests were carried out on the samples obtained to determine changes in the main physical-mechanical, thermal, flammability and decay properties.

As mentioned above, after the aqueous treatment of the modified fabric samples, these samples were dried and their flammability properties were checked, and based on these checks, their fire resistance properties were confirmed by test experiments.

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